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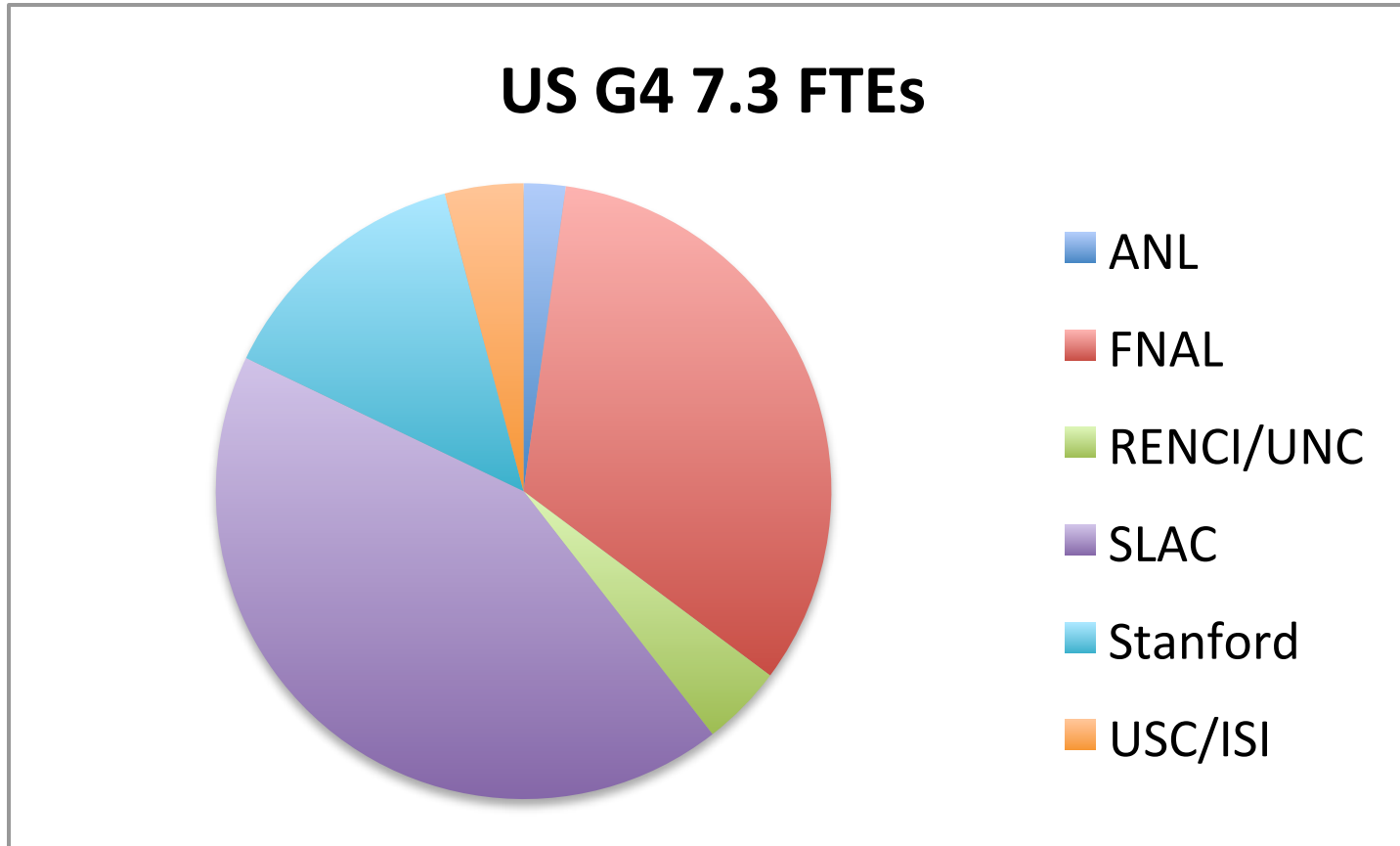
# Geant4 Re-engineering for HPC and More a US-Centric View

Richard P. Mount  
SLAC

*June 5, 2013*

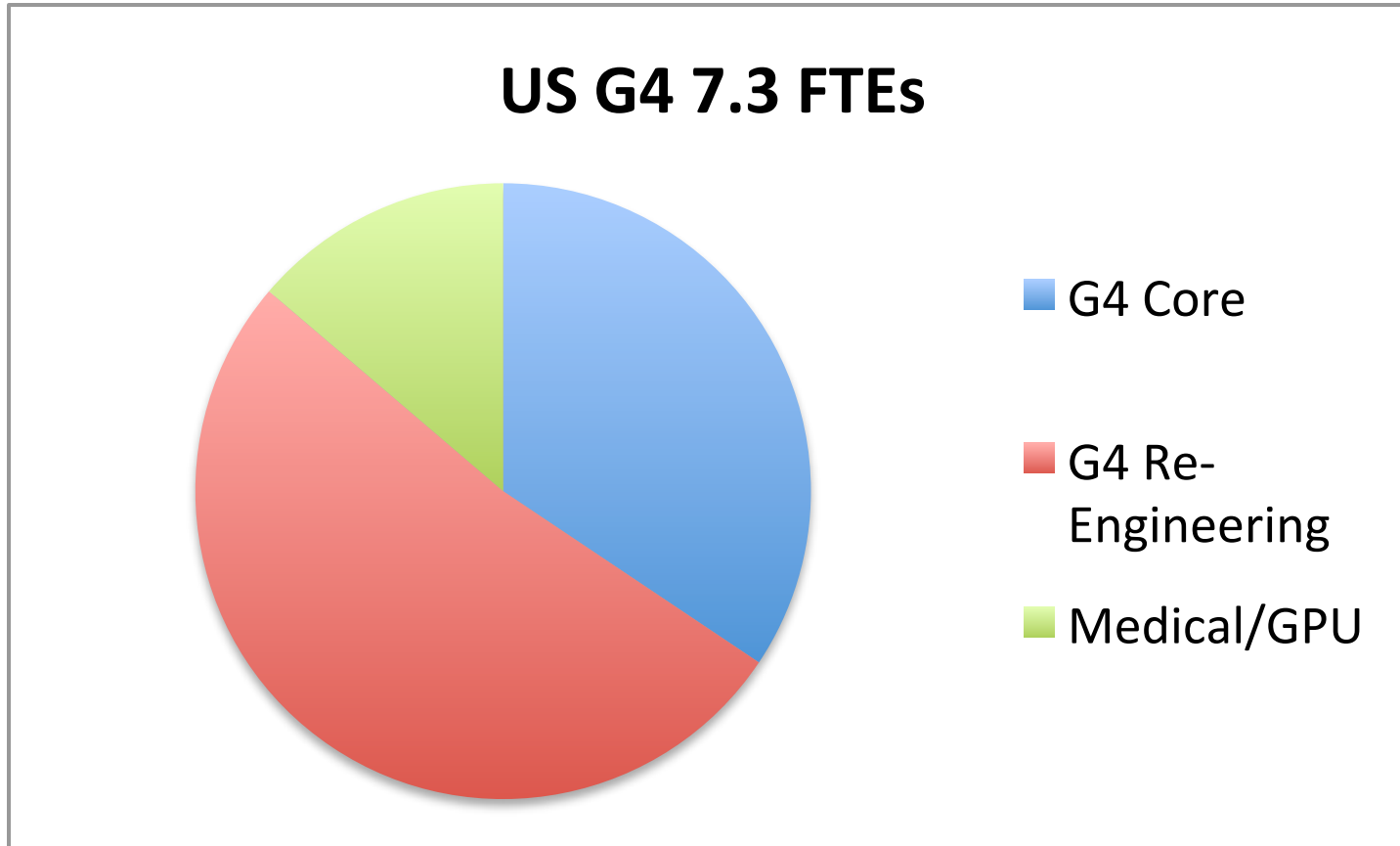
# US Geant4 Effort (Excluding Experiment/Application Support)

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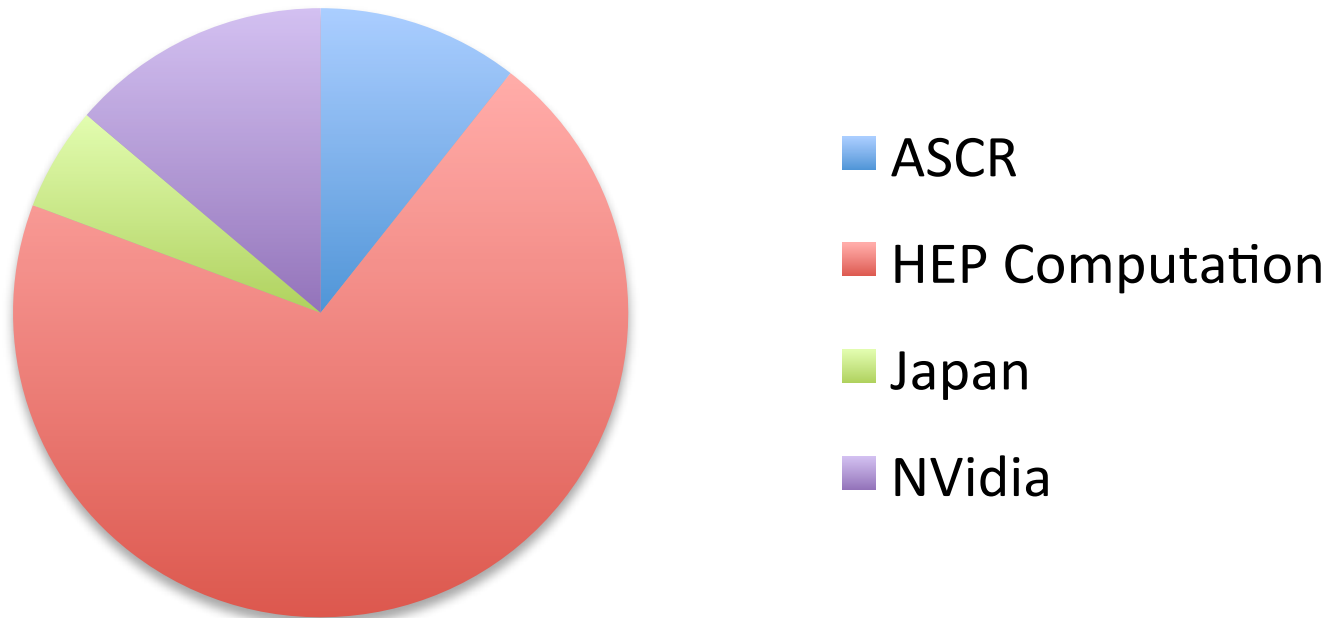


# US Geant4 Effort

(Excluding Experiment/Application Support)

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## US Geant4 7.3 FTEs



# Geant4 Restructuring and Performance Project

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## HEP-ASCR R&D Effort Towards Geant4 Re-engineering

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**Report Period: October 2012-May 2013**

Boyana Norris (norris@mcs.anl.gov) <sup>1</sup>

Philippe Canal (pcanal@fnal.gov), Daniel Elvira (daniel@fnal.gov), Soon Yung Jun (syjun@fnal.gov), Jim Kowalkowski (jbk@fnal.gov), Marc Paterno (paterno@fnal.gov). <sup>2</sup>

Paul Ruth (pruth@renci.org), Robert Fowler (rjf@renci.org). <sup>3</sup>

Pedro Diniz (pedro@isi.edu), Robert Lucas (rflucas@isi.edu). <sup>4</sup>

Makoto Asai (asai@slac.stanford.edu), Andrea Dotti (adotti@slac.stanford.edu). <sup>5</sup>

# Goals (of the 2-year Project)

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- A plan that serves as the foundation of a larger, multi-year effort to restructure Geant4, in coordination with the broader Geant4 collaboration and the users community.

# Project Activities (1)

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- Performance evaluation based on realistic Geant4 applications
  - » Fermilab + ASCR team are examining CMSexp (CMS simulation extracted from CMS software framework)
  - » Main tool is HPCtoolkit
- Alternative track stacker
  - » Fermi, ASCR, CERN
  - » Investigate why reorganizing the stack doesn't seem to help very much
  - » Just starting
- Review of G4 Electromagnetics
  - » Electromagnetics is where the CPU time goes
  - » Focus on CMSexp

# Project Activities (2)

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- GPU
  - » Assemble and develop tools for evaluating performance
  - » Develop tool to migrate geometry classes to GPUs
  - » Particle transportation. Numerical integration algorithms alternative to Runge-Kutta for the transportation of charged particles in a magnetic field.
  - » Electromagnetic physics. Standard EM physics processes for both electrons and photons.
  - » Random number generators. Efficient pseudo-random number generators (pRNG).
  - » Geometry navigator on GPU.
  - » Concurrent streams and multiple kernels.
  - » Validation framework to verify GPU prototype output.



## Project Activities (3)

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- Implementation of Multithreading in Geant4 Production Releases
  - » Contributes to funding the SLAC work on multithreading